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MAGNETIC RECORDING MEDIUM MANUFACTURING METHOD

CLAIM(S)

1) A magnetic recording medium manufacturing method, wherein a backing layer, magnetic layer, and a protective layer are successively formed on a substrate, and subsequently the surface of the protective layer is polished; said method being characterized in that said polishing is conducted in 1 hour after said protective layer has been formed.

2) A magnetic recording medium manufacturing method, as cited in Claim 1, wherein said polishing is conducted by contacting a synthetic resin film having a polishing agent with the surface of the protective layer while the protective layer is being rotated.

3) A magnetic recording medium manufacturing method, as cited in Claim 1 or Claim 2, wherein a lubricant layer is formed on the protective layer surface following said polishing.

DETAILED DESCRIPTION OF THE INVENTION

(0001)

(Field of Industrial Application)

The present invention pertains to a magnetic recording medium manufacturing method, more specifically, to the method to manufacture a high quality magnetic recording medium by a stable manufacturing method.

(0002)

(Technical Field of Application)

A magnetic recording medium is widely used as a recording device for a computer. According to its most representative manufacturing method, first, roughness called a texture is created on a circular aluminum or glass circular disk, which is a substrate. Subsequently, on top of this roughened substrate, a backing layer, such as that of Cr, a magnetic layer, and a protective layer are successively formed by sputtering, respectively. On the protective layer thus made, fine bumps are often generated, so these bumps have to be removed by polishing the surface of the protective layer with a polishing tape having a polishing agent. In this polishing process, while the substrate on which is formed the protective layer is being rotated around the central axis of a rotary device, a polishing tape, such as that of polyester, having a polishing agent is lightly contacted with it. A lubricant is provided

to the surface of the polished protective layer to form the lubricant layer, and thus a magnetic recording medium is manufactured. It will be desirable in terms of production efficiency if a continuous flow of steps is used for the operation from the formation of the texture to the formation of the lubricant layer for which the lubricant is provided.

(0003)

(Problems of the Prior Art to Be Addressed)

With the aforementioned manufacturing method, however, scratches are often generated in the protective layer surface at a time of polishing it, which is one of the causes leading to a lower yield. Therefore, the present invention attempts to present a method to minimize the scratches generated on the protective surface when the protective layer is polished.

(0004)

(Means to Solve the Problems)

According to the present invention, in the method to manufacture a magnetic recording medium, wherein the protective layer surface is polished after the magnetic layer and the protective layer have been successively formed, the scratch generation can be minimized at a time of polishing, since the protective layer surface is polished in 1 hour or more after the protective layer has been formed.

(0005)

(Embodiment Example)

The present invention is explained below in detail. The conventional method can be used for manufacturing the magnetic recording medium of the present invention except that the protective layer is polished in 1 hour or more, preferably, in 2 hours or more after the protective layer has been formed. As to the substrate, it is preferred to use an Al-Mg alloy substrate, which can be market-purchased by the trademark of "Substrate," and on this substrate, a backing film is formed by electroless plating, and a mirror-finishing process (polishing process) is applied to this backing film. It is possible to use a substrate made of copper, titanium, glass, ceramic, carbon, or silicon material.

(0006)

As in the conventional method, a texture process is first applied to the substrate. A texture process refers to the process, wherein an extremely fine strip pattern or roughness is created on the mirror surface of the backing film. If necessary, after the texture process, chemical etching or electrolytic etching may be performed, in some cases, to remove burr. The application of the texture process to the backing film prevents the magnetic head from

adhering to the magnetic recording medium, which improves a contact-stop-start characteristic and magnetic anisotropy.

(0007)

On the substrate, the backing layer is first formed. This backing layer can be a conventionally well-known non-magnetic backing layer. For example, it can be made of Cr, Ti or Ni. The Cr or Ti used for the backing layer may by an alloy containing a few percents of Si, V, and Cu. In the present invention, a Cr group is suited for the backing layer. The thickness of the backing layer is generally in the range of 50 – 2,000 Δ. The backing layer is generally formed by sputtering.

(0008)

The magnetic layer is formed on the backing layer. The magnetic layer generally is an alloy thin film layer made of cobalt group expressed by Co – Cr, Co – Ni, Co – Cr –X, Co – Ni – X, and Co – W – X. In this context, for the X, 1 or more elements selected out of Li, Si, P, Ca, Ti, V, Cr, Ni, As, Y, Zr, Nb, Mo, Ru, Rh, Ag, Sb, Hf, Ta, W, Re, Os, Ir, Pt, Au, La, Ce, Pr, Nd, Pm, Sm, and Eu is used.

(0009)

The magnetic layer also is generally formed by sputtering. The thickness of the magnetic layer is preferably in the range of 100 – 1,000 Δ.

On the magnetic layer, the protective layer is further formed. The protective layer is made of carbon film, cabon hydride film, carbon nitride film, carbide film, such as that of TiC or Sic, nitride film, such as that of SiN, or TiN, or oxide film, such as that of SiO, Al_2O_3, or ZrO. It is generally formed by sputtering. For the protective film, a carbon film, carbon hydride film or carbon nitride film is particularly preferable.

(0010)

A carbon hydride film contains hydrogen and carbon, and it can be, formed, for example, by sputtering in a plasma containing a sputtering gas (generally, an inert gas such as argon) and hydrogen gas by using a carbon target.

(0011)

A carbon nitride film contains nitrogen and carbon. It can be formed, for example, by sputtering in a plasma containing a sputtering gas and air, nitrogen gas, nitrogen monoxide, nitrogen dioxide, and nitrogen in monomer or compound form by using a carbon target. For example, when an air is used for a nitrogen source, the amount of the air in the sputtering atmosphere is generally 2 - 20 volume percents.

(0012)

In addition, for example, by mixing a hydrogen gas and a nitrogen gas in the sputtering gas, the hydrogenated and simultaneously nitrified carbon film can be formed. The thickness of the protective film is generally in the range of 30 – 1,000 Δ, preferably, in the range of nearly 50 – 600 Δ. The protective layer often has ultra fine bumps on the surface, so the surface is polished to remove the ultra fine bumps. In this polishing process, the substrate on which is formed the protective layer is rotated around the rotary axis of the rotary device, and the polishing tape made of synthetic resin film having a polishing agent is lightly contacted with the substrate. Fig. 1 shows the substrate being polished. As shown in the figure, the circular substrate 1 is rotated in the clockwise direction with its protective layer face up. The tape 2 made of film having the polishing particles is fed to contact with the surface of the protective layer at speed of a few mm/second. Above the tape, air box 3 is installed to partially contact with the tape. The air is supplied to the air box via the air supply pipe 4, and this air flows out of the slit 5 made in the bottom of the air box to lightly press the tape 2 against the substrate 1. The gap between the tip end of the slit and the substrate is 5 mm or less, preferably, 2 – 4 mm. By making the gas smaller, the pressing condition can be made constant, and the contact of the tape with the

substrate can be a face-contact instead of a line-contact. As to the tape used for polishing, the one having, on its polyethylene or polyamide film, alumina or silicon carbide grinding particles with 0.3 – 3 Φm particle size can be used. For example, "AWA 8000 FNY" or "AWA 8000 NAI-C" made by Nippon Micro Coating Co. can be used.

(0013)

In the present invention, the protective layer surface is polished in 1 hour, preferably, in 2 hours after the protective layer has been formed. According to the research conducted by the inventors of the present invention, the longer the time period is after the formation of the protective layer, the less the number of the generated scratches is at the time of polishing. In the beginning, they are drastically decreased and subsequently, the number gradually reaches a specific value. The probable reason is that the protective layer surface goes through changes while it is exposed to an atmospheric air after having been removed from the sputtering device. One of the changes is that a water content in an atmospheric air is attached to the protective layer surface and changes the surface to be smoother. Accordingly, it may be preferable to polish the protective layer surface after it is stabilized by setting it aside for a long time. But, for the convenience of production at a factory, it will be sufficient if it is set aside for 1 – 5 hours,

preferably, for 2 – 4 hours, between the protective layer formation and the polishing. A lubricant is supplied to the protective layer that has been polished by the conventional method to form the lubricant layer. Generally, a fluorine group liquid lubricant is coated on the protective layer surface.

(0014)

The present invention is further explained in detail below with reference to the embodiment example.

(Embodiment Example)

A polishing process and a texture process were applied to a 95 mm diameter aluminum alloy substrate on which Ni-P was plated by 10 Φm thickness by an electroless plating method. Subsequently, on this substrate, a 450 Δ thick Cr backing layer, a 250 Δ thick magnetic layer of Co – Cr – Ta alloy, and a 150 Δ thick protective layer of carbon containing a small amount of hydrogen and nitrogen were successively formed. After this substrate with the protective layer formed was left in a room for a specific period of time, the surface of the protective layer was polished with the polishing tape for nearly 4.5 seconds by using the following parameters. Then, the fluorine group liquid lubricant was coated on the protective layer surface by 18 Δ thickness to manufacture the magnetic recording medium.

(0015)

The polishing parameters

Types of tape:	AWA 10000 TNY-D (thickness 30 Φm)
Tape feeding speed:	1 +/- 0.4 (mm/second)
Tape tension:	80 (g)
Tape reciprocation:	once at 720 mm/minute
Number of substrate rotations:	2000 (rpm)

The Table 1 shows the relationship between the time period during which the substrate was set aside and the number of scratches generated. The polishing was applied to 50 surfaces by setting them aside for each time period indicated in the table, and the average number of scratches generated was computed. The scratches were examined before the lubricant was coated.

(0016)

Table 1

The time period during which the substrate was set aside (hr).	The number of scratches generated (scratches per surface)
0	0.16
1	0.04
3	0.02
9	0.00
24	0.00

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows the protective layer surface being polished with the tape.

Fig. 2 shows a sectional view of the C – C section of Fig. 1.

Fig. 3 shows a perspective view of the box of Fig. 1

1. substrate
2. polishing tape
3. air box
4. air supply pipe
5. slit